

REMARKS

As a preliminary matter, a machine translation of JP 07-095360 is enclosed herewith. JP 07-095360 was cited in the Information Disclosure Statement filed on July 12, 2004.

Claims 1-3, 8 and 9 stand rejected under 35 U.S.C. §102(b) as being anticipated by JP 7-95360 (hereinafter “JP ‘360”). Applicants respectfully traverse this rejection.

Applicants respectfully submit that JP ‘360 fails to disclose all of the features of the present invention. More specifically, JP ‘360 fails to disclose a lighting unit that includes, *inter alia*, a light source that is a light emitter, where that light emitter is arranged in close contact with a top of a truncated pyramid, where that top consists of an outermost peripheral planar surface, as defined in amended independent Claim 1.

One example of an embodiment of the invention of Claim 1 is shown in Applicants’ Figure 2, which includes light emitter 14 that is arranged in close contact with outermost peripheral planar surface 16b of truncated pyramid 16 (Figure 1).

Initially, Applicants would like to point out that Figure 20 of JP ‘360 shows the details of light source 8 of Figures 18, 19, 21 and 22. More specifically, Figure 20 of JP ‘360 shows how light source 8 includes a substrate 81 and a “mold section” 82. *See* paragraph [0061] of the enclosed machine translation of JP ‘360. Further, within “mold section” 82 is located LED 1. In amended Claim 1, the “light source” is now defined as being a “light emitter.” Thus, LED 1 of Figure 20 is the component of JP ‘360 that most closely resembles the claimed “light source, which is a light emitter,” and not the entire combination of

components 81, 82 and 1 of Figure 20. Substrate 81, which is merely a base for a light emitter and does not emit light, is especially not equivalent to the claimed “light source, which is a light emitter.”

The sub-assembly of Figure 20 (components 81, 82 and LED 1) is inserted into a hole 46, as shown in Figure 19 of JP ‘360. *See* paragraph [0060] of the enclosed machine translation of JP ‘360. Thus, with hole 46, the embodiment of Figures 18-22 of JP ‘360 requires precise manufacturing tolerances between the depth of the hole and the height of the light source (the combination of components 81, 82 and LED 1). For example, if the hole is too deep, a layer of air may occur between the top of the truncated pyramid and the light source (the combination of components 81, 82 and LED 1).

In contrast, in the present invention, since the top of the truncated pyramid is a “planar” surface, the light source is simply affixed to the planar surface, and such precise tolerances are not required. Thus, the manufacturing process for the present invention is easier than that required for JP ‘360.

In summary, the present invention of independent Claim 1 is different from the apparatus of JP ‘360 because JP ‘360 lacks a light emitter that is in close contact with the outermost peripheral planar surface of a truncated pyramid. In contrast, the outermost peripheral surface of JP ‘360 is not “planar,” but instead includes hole 46, and in addition the light emitter LED 1 of JP ‘360 is separated from being in close contact with the outermost peripheral surface of the truncated pyramid of JP ‘360 by substrate 81. Accordingly, for at

least these reasons, Applicants respectfully request the withdrawal of this §102(b) rejection of independent Claim 1 and associated dependent Claims 2, 3, 8, 9 and 12 under JP '360.

Claims 13 and 14 stand rejected under 35 U.S.C. §102(b) as being anticipated by United States Patent Application Publication No. 2001/0017774 to Ito et al. Applicants have cancelled independent Claim 13, without prejudice, and have amended dependent Claim 14 so that it no longer refers to Claim 13. Accordingly, this rejection of Claims 13 and 14 has been rendered moot.

Claims 4, 6, 14/1-14/4, 14/6, 14/8, 14/9 and 14/12 stand rejected under 35 U.S.C. §103 as being unpatentable over JP '360 in view of United States Patent No. 6,164,789 to Unger et al. Applicants respectfully traverse this rejection.

Claims 4, 6, 14/1-14/4, 14/6, 14/8, 14/9 and 14/12 all depend, directly or indirectly, from independent Claim 1, and therefore include all of the features of Claim 1, plus additional features. Accordingly, Applicants respectfully request that this §103 rejection be withdrawn considering the above remarks directed to independent Claim 1, and also because the Unger et al. reference does not remedy the deficiencies noted above, nor was it relied upon as such.

Claim 10 stands rejected under 35 U.S.C. §103 as being unpatentable over JP '360 in view of United States Patent No. 7,001,058 to Inditsky. Applicants respectfully traverse this rejection.

Claim 10 depends from independent Claim 1, and therefore includes all of the features of Claim 1, plus additional features. Accordingly, Applicants respectfully request

that this §103 rejection be withdrawn considering the above remarks directed to independent Claim 1, and also because the Inditsky reference does not remedy the deficiencies noted above, nor was it relied upon as such.

Claims 5 and 11 stand rejected under 35 U.S.C. §103 as being unpatentable over JP '360 in view of United States Patent No. 5,359,691 to Tai et al. Applicants respectfully traverse this rejection.

Claims 5 and 11 both depend from independent Claim 1, and therefore include all of the features of Claim 1, plus additional features. Accordingly, Applicants respectfully request that this §103 rejection be withdrawn considering the above remarks directed to independent Claim 1, and also because the Tai et al. reference does not remedy the deficiencies noted above, nor was it relied upon as such.

Applicants have added new Claims 51-57. New Claims 51-57 are dependent claims that each refer back to independent Claim 1, and Applicants respectfully submit that these new dependent claims are allowable for at least the same reasons that render associated independent Claim 1 allowable.

Further, with regard to new dependent Claim 53, Applicants respectfully submit that JP '360 fails to disclose all of the features of the claim. More specifically, JP '360 fails to disclose a lighting unit that includes, *inter alia*, a truncated pyramid and a light guide plate including two side edges between a first face and a second face, where “one of said side edges of said light guide plate is arranged in close contact with said base of the truncated pyramid,” as defined in new dependent Claim 53.

In the invention of Claim 53, one embodiment of which is shown in Applicants' Figures 1 and 2, there is a truncated pyramid 16 and a light guide plate 12. As can be seen in Figure 1, the light guide plate 12 includes two side edges (i.e., right and left side edges, as depicted in the figures) between first and second faces (i.e., upper and lower faces, as depicted in the figures), where one of the side edges of the light guide plate 12 is arranged in close contact with the base 16a of the truncated pyramid 16.

In contrast, as can be seen in Figure 18 of JP '360, the base of section 4b' is not in close contact with one of the side edges of light guide plate 4a'. Instead of being in close contact with one of the side edges, the base of section 4b' of Figure 18 of JP '360 is in close contact with one of the faces of light guide plate 4a'. Thus, as all of the features of dependent Claim 53 are not disclosed in JP '360, Applicants respectfully submit that new Claim 53 is allowable over the references of record.

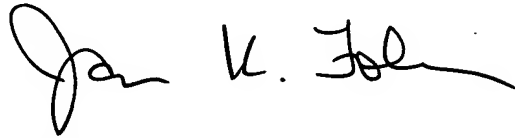
For all of the above reasons, Applicants request reconsideration and allowance of the claimed invention. Should the Examiner be of the opinion that a telephone conference

would aid in the prosecution of the application, or that outstanding issues exist, the Examiner is invited to contact the undersigned.

Respectfully submitted,

GREER, BURNS & CRAIN, LTD.

By

A handwritten signature in black ink, appearing to read "James K. Folker". The signature is fluid and cursive, with the first name "James" being more prominent.

James K. Folker

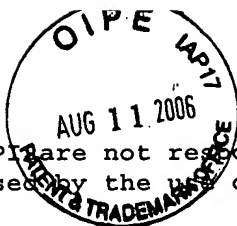
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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the light equipment used as the light sources for manuscript lighting, such as facsimile, a copying machine, and an image scanner, etc.

[0002]

[Description of the Prior Art] It had the LED array substrate 102 which has LED101 mounted in the shape of an array, and the lens 103 of the shape of a semi-cylindrical shape arranged above this LED array substrate 102, and the light of X shaft orientations of LED101 was extracted with said lens 103, and what irradiates light to the manuscript (un-illustrating) of the lens upper part was used so that it might be shown in the former, for example, drawing 24, as light equipment, such as facsimile.

[0003]

[Problem(s) to be Solved by the Invention] However, in light equipment as shown in drawing 24, when the ripple of an illuminance arose for every arrangement spacing of LED101 in Y shaft orientations of light equipment and it was used as light equipment, such as facsimile, the problem which cannot illuminate a manuscript side was in homogeneity. Although there was the approach of increasing LED101 and making arrangement spacing small in order to prevent a ripple, there was a problem which becomes cost quantity. Although the ripple could be made small by separating light equipment from a manuscript side, since it spread and emanated, light had the problem to which the use effectiveness of light worsens, when the manuscript was kept away from LED1.

[0004] Moreover, with the conventional configuration, adhesion immobilization of the lens 103 was carried out at the LED array substrate 102 which mounted two or more LED101, and since it was immobilization with the LED array substrate 102 and lens 103 which took about wiring, there was a problem which adhesion precision cannot take easily.

[0005] Furthermore, when the defect of LED101 occurred, there was a problem which cannot exchange only LED101 part and which can exchange all only by one.

[0006] One of the purposes of this invention is to offer the light equipment which can obtain a linear light without a ripple and can prevent the adhesion gap with the light source, a lens, etc., and the futility at the time of exchange.

[0007]

[Means for Solving the Problem] The substrate which has arranged two or more light sources which invention according to claim 1 becomes from LED etc. in the shape of an array, The light guide section of the configuration where it has been arranged at each luminescence top panel side of two or more of said light sources, and the luminescence top panel side spread, It is characterized by being arranged at the luminescence top panel side of said light guide section, having the translucent part which emits light from the glory output screen which introduced the light of each light guide section, accumulating the direct light from said light source, and the light reflected in respect of the side attachment wall of said light guide section, and making it output from said optical output side.

[0008] Invention according to claim 2 is characterized by setting the tilt angle of the side-attachment-wall side of said light guide section as the include angle which carries out total reflection of the light of the light source in light equipment according to claim 1.

[0009] Invention according to claim 3 is characterized by establishing the light reflex side which reflects the light of the light source in a luminescence top panel side in the substrate which has arranged said light source in light equipment given in either claim 1 or claim 2.

[0010] In the light equipment to which pass the inside of transparent translucent part material, and the light of the light source is made to output from the optical output side of this translucent part material, invention according to claim 4 prepares a light source applied part and a circuit pattern in said translucent part material, and is characterized by supplying a current to the light source with which said light source applied part was equipped with said circuit

pattern.

[0011] In light equipment according to claim 4, invention according to claim 5 is characterized by the thing of said light source section and translucent part material for which connector structure was prepared in either at least, and the light source section and translucent part material were constituted free [attachment and detachment] electrically and mechanically while it is divided and equipped with the light source section including said light source, and the translucent part material which is made to pass the light of the light source and is made to output from an optical output side.

[0012] Invention according to claim 6 is characterized by preparing a current control means in either of claims 4 or 5 in the light equipment of a publication at the circuit pattern of said translucent part material.

[0013]

[Function] In invention according to claim 1, although the luminescence light of the light source which consists of LED etc. is led to a translucent part through a light guide section and it is outputted from the optical output side of a translucent part, light is accumulated as follows at this time. First, the light which goes to a luminescence top panel side from the light source goes into a translucent part through a light guide section as it is, and is outputted from an optical output side. On the other hand, it is reflected in respect of the side attachment wall of a light guide section, and the light which spread around goes to an optical output side side. Such light is accumulated and it is outputted from the fixed range of an optical output side. Thus, since a spreading light is reflected and condensed, even if it separates the location of the light source from an optical output side, the futility of light does not arise. That is, even when distance of the light source and an optical exposure side (manuscript) is lengthened when two or more light sources are used, and a ripple is lessened, the futility of light does not arise.

[0014] In invention according to claim 2, since total reflection of the light is carried out in said light guide section, light is used efficiently.

[0015] In invention according to claim 3, since the light which spread around from the light source is reflected in the bottom, light is used effectively.

[0016] In invention according to claim 4, a circuit pattern is prepared in translucent part material, and since it is the configuration that this translucent part material is equipped with the light source, even if it exchanges the light source section, wiring can be used as it is.

[0017] In invention according to claim 5, according to connector structure, since it can detach and attach freely to translucent part material, the light source section can perform exchange, repair, etc. of the light source section easily. According to this connector structure, since both electrical installation and mechanical connections are performed to coincidence, exchange and repair become very easy.

[0018] In invention according to claim 6, since the current control means is prepared in the circuit pattern, when it has two or more light source parts, the supply current value to each light source part can be set up suitably. This enables it to change the luminescence quantity of light of two or more light source parts into a fixed condition.

[0019]

[Example] <Example of claims 1-3> drawing 1 and drawing 2 are drawings showing the example of a configuration of the light equipment of the example of claims 1-3, and drawing 3 and drawing 4 are drawings for explaining how depending on which light progresses in this light equipment.

[0020] The LED array substrate 2 with which LED1 is mounted consists of glass epoxy group plates etc. The LED array substrate 2 forms reverse truncated four-sided pyramidal crevice 2a in a top face, and mounts LED1 in the bottom of this crevice 2a. Crevice 2a is prepared by the number of LED to mount, and one LED1 is mounted in the bottom of each crevice 2a, respectively. This crevice 2a corresponds to a light reflex side according to claim 3. Since light is reflected in a luminescence top panel side, it inclines and crevice 2a is prepared so that the side-attachment-wall side 21 may spread in a luminescence top panel side. Speculum side processing of the wall of crevice 2a is carried out by plating, vacuum evaporation, sputtering, etc. After LED1 is mounted, the closure of the crevice 2a is carried out with transparence resin or clear glass. In addition, an acrylic, a polycarbonate, polyolefine, etc. are used as transparence resin.

[0021] The lightguide plate 4 which introduces the light of LED1 is formed above the LED array substrate 2. The lightguide plate 4 is formed by injection shaping etc. with transparence resin, such as an acrylic, a polycarbonate, and polyolefine, or clear glass. The lightguide plate 4 has tabular translucent part 4a and reverse truncated four-sided pyramidal light guide section 4b which projected caudad and was formed from this translucent part 4a. The light guide side 41 which is a base of light guide section 4b pastes up with the top face of the closure section of crevice 2a of said LED array substrate 2 (refer to drawing 2).

[0022] Next, how depending on which the light in this light equipment progresses is explained.

[0023] As described above, mirror plane processing of the wall of crevice 2a of the LED array substrate 2 is carried out, and as shown in drawing 3 , it is reflected in respect of [21] direct or a side attachment wall, and the

luminescence light of LED1 is drawn in the direction of a luminescence top panel, and carries out incidence to light guide section 4b of the lightguide plate 4.

[0024] In the lightguide plate 4, as shown in drawing 4, the light emitted near the direction of a perpendicular of the luminescence top panel of LED1 among the introduced light passes light guide section 4b and translucent part 4a as it is, and a direct output is carried out from the optical output side 42. Moreover, it is reflected in the inclination interface (side-attachment-wall side) 43 of light guide section 4b, and a large light of breadth is outputted from the optical output side 42.

[0025] That is, according to the configuration of this example, even if the distance of LED1 and the exposure side (manuscript) of light is long, the light emitted from LED1 is collected within the limits of [of the optical output side 42] predetermined, being reflected in the side-attachment-wall side 21 of direct or crevice 2a, or the inclination interface 43 of light guide section 4b. Therefore, light spreads beyond the need and does not cause a quantity of light fall. And said predetermined range in the optical output side 42 can be set as arbitration by setting the tilt angle of the side-attachment-wall side 21 of crevice 2a, and the inclination interface 43 of light guide section 4b as a suitable include angle.

[0026] For example, the include angle of the side-attachment-wall side 21 of crevice 2a is set as an include angle to which the reflected light, if possible, reaches the direct optical output side 42. Moreover, the tilt angle of the inclination interface 43 of light guide section 4b is set as an include angle which carries out total reflection of the light. By setting the tilt angle of the inclination interface 43 of light guide section 4b as the include angle which carries out total reflection of the light, light cannot be leaked to the exterior and light can be reflected without absorption loss of reflex time in the optical output side 42 direction.

[0027] By this, since the light of LED can be used efficiently, distance of LED1 and the optical output side 42 can be lengthened. And by lengthening distance of LED1 and the optical output side 42, the ripple of the illuminance in Y shaft orientations can be made small, and a linear light can be obtained in Y shaft orientations. Moreover, since light concentrates in a predetermined field also in X shaft orientations by the light reflex in the inclination interface 43 of light guide section 4b, the use effectiveness of light can be raised.

[0028] Drawing 5 and drawing 6 are drawings showing other examples of a configuration.

[0029] This example is the thing of a configuration of not preparing crevice 2a in the LED array substrate 2, but inserting LED1 in the lower limit section of the lightguide plate 4.

[0030] In this example, as shown in drawing 6, the LED array substrate 2 is a flat tabular thing like the usual substrate, and is constituted, and the chip of LED1 is mounted in a top face in the shape of an array. On the other hand, like the above-mentioned example, although the lightguide plate 4 is equipped with translucent part 4a and light guide section 4b, it is further equipped with Idemitsu section 4c under this light guide section 4b. Idemitsu section 4c is constituted almost like the configuration of crevice 2a of the above-mentioned example, had the side-attachment-wall side 44 which reflects light in a luminescence top panel side, and has performed speculum side processing to the external surface of this side-attachment-wall side 44. As shown in drawing 6, the crevice 45 for inserting in LED1 is formed in the base of Idemitsu section 4c. After mounting LED1 on the LED array substrate 2, the lightguide plate 4 is set and a crevice 45 is closed by transparence resin after that so that the crevice 45 of said Idemitsu section 4c may suit LED1.

[0031] The LED array substrate 2 and the lightguide plate 4 which carried LED1 as mentioned above can paste up, and the light of LED1 can be made to condense like the example shown in drawing 1 and drawing 2 within the limits of [of the optical output side 42 of the lightguide plate 4] predetermined.

[0032] Next, the setting approach of the tilt angle of the inclination interface 43 of light guide section 4b is explained based on an example. In addition, also in the case of the example shown in drawing 5 and drawing 6, although this example is the thing of the example shown in drawing 1 and drawing 2, it is the same.

[0033] Now translucent part 4a of the lightguide plate 4 The thickness of T:4mm, height of H:25mm, Constituting tabular [with a die length of L:260mm] and light guide section 4b in width of face of d:3mm of the pars basilaris ossis occipitalis of the light guide side 41, and truncated four-sided pyramidal [height tg:2mm], crevice 2a of the LED array substrate 2 presupposes that it constituted in truncated four-sided pyramidal [with a width of face / of the contact surface with the light guide side 41 / of d:3mm /, and a depth of t:0.8mm].

[0034] Here, in order to carry out total reflection of all the light of LED1, the tilt angle theta of the inclination interface 43 of light guide section 4b needs to fulfill the following conditions (refer to drawing 7).

[0035] $\theta < 90 \text{ degree} + \tan^{-1}(2 t/d) - \sin^{-1}(n_1 / n_2)$

However, the depth of crevice 2a of t:LED-array substrate, d: The width of face of the light guide side of light guide section 4b, n_1 : The flexion rate of air, n_2 : Flexion rate of a transparence medium.

[0036] At the example of the above [this], angle-of-inclination theta is 80deg(s). It is set as below. In addition, the decision of the configuration of the configuration of optimal light guide section 4b and crevice 2b of the LED array

substrate 2 carrying an LED chip performs an optical simulation, changing an angle of inclination by above-mentioned include-angle within the limits, and its use effectiveness of light is good and it is performed by asking for whenever [suitable tilt-angle / which becomes illumination distribution with a small ripple].

[0037] About the light equipment of the above configurations, an optical simulation is performed and the result of having searched for illumination distribution is shown in drawing 8 (A) and (B). In addition, 13 LED chips were used in this example. Distribution of X shaft orientations is shown in this drawing (A) at Y shaft orientations and (B) about the case of the distance of H= 1mm of *****, the optical outgoing radiation end face 42, and a manuscript, 3mm, and 6.5mm. From this, when the ripple value of distribution was calculated whenever [use effectiveness / of light /, and Mitsuteru], the value of 65% of use effectiveness and 10% of ripple values was acquired. As for this value, use effectiveness of a ripple value [about 3 times and] is improving about to 2/3 to the actual measurement by the light equipment by the conventional configuration.

[0038] In addition, a ripple value is calculated by the following formulas.

[0039] $(I_{\max} - I_{\min}) / (I_{\max} + I_{\min})$

However, I_{\max} : The maximum illuminance, I_{\min} : The minimum illuminance.

[0040] As mentioned above, a linear light without a ripple was able to be obtained by accumulating light with the lightguide plate 4 which has light guide section 4b of the configuration where the luminescence top panel side spread.

[0041] In addition, when this light equipment was actually applied to the facsimile corresponding to B4 size, the number of LED to be used was able to become about 20 reduction as compared with the former, and was able to achieve power-saving of about 1 kw.

[0042] <Example of claim 4> drawing 9 -13 are drawing showing the example of a configuration of the light equipment concerning claim 4. The light equipment of this example has a translucent plate 5, the light source section 6 (6a, 6b), and connector 7a and false connector 7b, and as shown in drawing 9, after attaching the light source sections 6a and 6b in the edge of right and left of a translucent plate 5, it is constituted by attaching connector 7a and false connector 7b so that the light source sections 6a and 6b may be covered, as shown in drawing 10.

[0043] Hereafter, a configuration is explained to a detail.

[0044] Drawing 11 (A), (B), and (C) are the front view of a translucent plate 5, rear view, and a side elevation, respectively. Moreover, drawing 12 (D) is the external view of the light source section 6, and drawing 12 (A), (B), and (C) are the A-A sectional view, a B-B sectional view, and a C-C sectional view. Furthermore, drawing 13 is the external view of connector 7a.

[0045] A translucent plate 5 consists of transparence resin, such as a polycarbonate, or clear glass, and is constituted by the oblong square pole configuration. Deflection NERUMIRA 51 is formed in the inferior surface of tongue of this translucent plate 5. Deflection NERUMIRA 51 forms the inferior-surface-of-tongue section of a translucent plate 5 in serrate, and adds metal membranes, such as an ingredient with the high rate of a light reflex, for example, aluminum etc., to this serrate section. The concave insertion hole 53 (53a, 53b) for attaching the light source section 6 is formed in the end face of right and left of a translucent plate 5, respectively. The light source section 6 shown in drawing 12 is inserted in this insertion hole 53.

[0046] The light source section 6 mounts two or more LED1 on the substrate 61 which consists of resin, such as a high resin liquid crystal polymer of protection-from-light nature, and carries out the mold of the it top with the good epoxy resin of light transmission nature etc. (mold section 62). This mold section 62 has convex and this convex part is inserted in the insertion hole 53 of said translucent plate 5.

[0047] Connector 7a is mostly formed in a core box so that the edge of light source section 6a and a translucent plate 5 may be covered with resin shaping, and after it attaches light source section 6a in a translucent plate 5, it is inserted in on it. In addition, false connector 7b is constituted almost similarly.

[0048] If the light equipment constituted as mentioned above is made to turn on, it will be reflected by deflection NERUMIRA 51 of a translucent plate 5, and the light emitted from LED1 of the light source section 6 will be outputted from the optical output side 52 of the top face of a translucent plate 5.

[0049] This light equipment is connected to an external power by connector 7a, and a current is supplied to the light source sections 6a and 6b through a translucent plate 5 from connector 7a. This configuration is explained to a detail.

[0050] The external power terminal 54 (54a, 54b) connected electrically at connector 7a, the circuit pattern 55 (55a, 55b) for supplying a current to the light source sections 6a and 6b, and ** are prepared in the translucent plate 5. In addition, in this example, the direct current is supplied to light source section 6a from the external power terminal 54. In this example, external power terminal 54a and circuit pattern 55a by the side of minus are prepared, and external power terminal 54b and circuit pattern 55b by the side of plus are prepared in the front-face side at the rear-face side.

[0051] The most general production approach as the formation approach of the external power terminal 54 or a circuit pattern 55 prints the conductive paste with which conductive powder, such as silver and copper, was mixed by print

processes, and is an approach. However, before using other approaches, for example, fabricating a translucent plate 5 with metal mold, put circuit pattern material, such as copper foil, into the metal mold side beforehand, and the resin which is the ingredient of a translucent plate is slushed there. In order to plate silver, copper, etc. to said produced shaping replica method which carries out a circuit pattern imprint, and the translucent plate 5 fabricated beforehand Catalysts, such as a palladium chloride, are printed and the approach of sticking the approach of forming by the electroless deposition method, an adhesive electric conduction tape, etc. on a circuit pattern etc. may be used. Moreover, although both the external power terminal 54 and the circuit pattern 55 are formed in the front face of a translucent plate 5 in this example, you may form so that it may embed to the interior of a translucent plate 5 about a circuit pattern 55.

[0052] By the way, when forming a circuit pattern 55, it is desirable to produce in the location distant from the optical output side 52. within a translucent plate 5, the light outputted from the light source section 6 outputs from the optical output side 52 using total reflection -- **** -- it is because the effect a circuit pattern 55 affects propagation of light will become large if a circuit pattern 55 is produced near the optical output side 52. In the case of this example, circuit pattern 55b of a minus polarity supplies a current to the light source section 6 by the side (upper limit side) near the optical output side 52, as shown in drawing 11 (B), but in the center section of the translucent plate 5, it has prevented that form a circuit pattern 55 in a lower limit side, and circuit pattern 55b affects propagation of light.

[0053] On the substrate 61 of the light source section 6, as shown in drawing 12, the circuit pattern 63 (63a, 63b) is formed. A circuit pattern 63 consists of conductive material, such as gold, aluminum, and copper, and is formed by approaches, such as plating and vacuum evaporation. Circuit pattern 63a is the pattern of the L character mold formed along with two sides of the top face of the shape of a rectangle of a substrate 61. Moreover, circuit pattern 63b is the pattern of the L character mold formed along with other two different sides from the above-mentioned circuit pattern 63a. Some LED1 is carried on circuit pattern 63a, and the minus electrode of LED1 is connected. The plus electrode of LED1 is connected to circuit pattern 63b by wirebonding. In addition, in this example, LED1 may connect some or all LED to a serial, although it connects with juxtaposition altogether.

[0054] Thus, as described above, the mold of the substrate with which LED1 was mounted is carried out with the epoxy resin etc. While being able to acquire the effectiveness of protection of wires, such as a gold streak connected to LED1, and improvement in the external quantum efficiency of LED1 by this mold, the convex type for making the light source section 6 insert in the insertion hole 53 of a translucent plate 5 can be formed.

[0055] As shown in drawing 12 (A) and (C), the mold section 62 is formed so that it may leave the peripheral surface section of a circuit pattern 63 (it exposes like). This exposed part is connected to the external power terminal 54 or circuit pattern 55 by the side of a translucent plate 5. In addition, in this example, circuit pattern 63a is connected to external power terminal 54a of a minus polarity by the side of a front face, and circuit pattern 55a, and circuit pattern 63b is connected to the external power terminal 54 of a plus polarity by the side of a rear face, and circuit pattern 55b.

[0056] About connection between the external power terminal 54 of a translucent plate 5, a circuit pattern 55, and the circuit pattern 63 of the light source section 6, it is also possible to add soldering paste, a silver paste, etc. to the external power terminal 54 of a translucent plate 5 and the circuit pattern 55, and to connect and paste up the light source section 6 on them. In this case, if the thing of a heat-curing mold is used as said conductive paste, it is necessary to use a heat-resistant high polycarbonate etc. as an ingredient of a translucent plate 5 but, and if the conductive paste of a cold cure mold or the conductive paste of an ultraviolet curing mold is used, it is also possible to use an ingredient with low thermal resistance, such as an acrylic.

[0057] As mentioned above, after the light source sections 6a and 6b are attached in the edge of right and left of a translucent plate 5, connector 7a and false connector 7b are attached.

[0058] Although false connector 7b is the configuration of only casing, the terminals 71a and 71b for supplying a current to the external power terminals 54a and 54b of a translucent plate 5 are formed in connector 7a. Terminal 71a by the side of minus is connected to external electrode terminal 54a by the side of a front face, and terminal 71b by the side of plus is connected to external electrode terminal 54b by the side of a rear face. A current is supplied to light equipment by this.

[0059] Drawing 18 - drawing 19 are drawings showing other examples concerning claim 4, and are the example which applied the configuration of this claim 4 to the light equipment using a lightguide plate. Drawing in which drawing 18 shows the appearance of the light equipment of this example, drawing 19 (A), (B), and (C) are the front view of a lightguide plate, rear view, a bottom view, and an external view of the light source section where drawing 20 (C) is equipped with the light source, and drawing 20 (A) and (B) are that A-A sectional view and a B-B sectional view.

[0060] The insertion hole 46 is formed in light guide side 41 of lightguide plate 4", and it is equipped with the light source section 8. Two or more light guide section 4b' is formed in lightguide plate 4', and each light guide section 4b'

is equipped with the light source section 8, respectively.

[0061] After the light source section 8 forms circuit pattern 83a by the side of minus, and circuit pattern 83b by the side of plus and mounts LED1 on a substrate 81, it performs mold (mold section 82). The mold section 82 is formed in the core box, and is inserted in the insertion hole 46 of said lightguide plate 4'.

[0062] Terminals 9a and 9b are formed in the part which circuit patterns 83a and 83b contact when lightguide plate 4' is equipped with the light source section 8. As Terminals 9a and 9b are shown in drawing 19 (A), the terminal of each light guide section 4b' is connected to a serial, terminal 9a is connected to the external power terminal 10a side of a minus polarity by the circuit pattern 9 formed in the front face of lightguide plate 4', and terminal 9b is connected to the external power terminal 10b side of a plus polarity. Therefore, when the insertion hole 46 of each light guide section 4b' is equipped with the light source section 8, it connects with a serial and each light source section 8 lights up. In addition, it is also possible to connect all or a part of light source sections 8 to juxtaposition by the method of connection of the terminals 9a and 9b by the circuit pattern 9.

[0063] <the example of claim 5> -- if the circuit pattern 55 of a translucent plate 5 and the circuit patterns 63a and 63b of the light source section 6 are pasted up with a conductive paste as mentioned above, attachment and detachment with a translucent plate 5 and the light source section 6 will become a little difficult. Then, both can be easily detached now and attached by [of the light source section 6 or a translucent plate] making either into connector structure at least. This example of a configuration is explained.

[0064] Drawing 14 is drawing showing the example at the time of applying claim 5 in light equipment equipped with deflection NERUMIRA.

[0065] As shown in this drawing (A), circuit pattern 56a (the rear-face side which is not illustrated is 56b) is formed in the front face of translucent plate 5', and the external power terminals 57a and 57b are formed in the edge. Moreover, the pinching section 58 is formed in the edge of translucent plate 5'. A cross section is the notching section mostly formed in horseshoe-shaped, and the pinching section 58 is formed so that the release one end may narrow a little. On the other hand, light source section 6' is formed in the four[about]-sided prism configuration as shown in this drawing (C), and circuit patterns 64a and 64b are formed in the front face. By inserting this light source section 6' in the pinching section 58 of said translucent plate 5', as shown in this drawing (B), light source section 6' is pinched by the pinching section 58. It is equipped with connector 7a as besides shown in drawing 13. In addition, although only the left-hand side light source section is shown by a diagram, and the right-hand side light source section is not equipped with an external power terminal, it is constituted almost similarly.

[0066] Drawing 15 is drawing showing other examples at the time of applying claim 5 in light equipment equipped with deflection NERUMIRA.

[0067] The translucent plate 5 of this example is constituted by the same configuration as the translucent plate 5 shown in drawing 11. On the other hand, light source section 6" is formed in horseshoe-shaped by projecting at the edge of the upper and lower sides of substrate 61", and forming Pieces 64a and 64b, as shown in this drawing (C). These pieces 64a and 64b of a protrusion are formed so that release one end may narrow. substrate 61" -- upwards, LED1 is mounted like the light source section 6 shown in drawing 12, and the mold section 62 is formed in it. Thus, if a translucent plate 5 is equipped with light source section 6" constituted, as shown in this drawing (C), the upper and lower sides of a translucent plate 5 will be pinched by the pieces 64a and 64b of a protrusion of light source section 6". In addition, the external power is connected to light source section 6" of this example, and if light source section 6" is connected to a translucent plate 5, a current will be supplied also to the light source section (un-illustrating) of another side.

[0068] In addition, when making both or one side of light guide section 4b[of lightguide plate 4'], and the light source section 8 into connector structure similarly in the light equipment using a lightguide plate as shown in drawing 18, it becomes possible to constitute lightguide plate 4' and the light source section 8, enabling free attachment and detachment.

[0069] <Example of claim 6> drawing 16 is drawing showing the example at the time of applying claim 6 in light equipment equipped with deflection NERUMIRA.

[0070] Although the current supplied to the external power terminal 54 is supplied to the light source section 6 through a circuit pattern 59 from connector 7a (un-illustrating), since the light source section 6a is nearer than light source section 6b, the current value of light source section 6a and the current value of light source section 6b may change at this time. Then, he is trying for Both 6a and 6b current value to turn into an equivalent value in this example by adding resistance 60b to circuit pattern 59b which adds resistance 60a to circuit pattern 59a connected to light source section 6a, and is connected to light source section 6b, and making high the resistance by the side of resistance 60b. Dispersion in the luminescence quantity of light of both the light sources 6a and 6b can be abolished by this.

[0071] Drawing 17 is drawing showing other examples at the time of applying claim 6 in light equipment equipped

with deflection NERUMIRA.

[0072] He is trying for the current value of the light source sections 6a and 6b to become almost equivalent in this example by making thick circuit pattern 11b which makes thin circuit pattern 11a which supplies a current to light source section 6a, and carries out current supply to light source section 6b.

[0073] Moreover, drawing 21 -23 are drawing showing the example of further others of claim 6, and are drawing showing the example of the light equipment using lightguide plate 4'.

[0074] the resistance 91a and 91b of resistance which connects to a serial the light source section (LED1) by which two or more unit protection arrival is carried out by the three-piece lot, connects the light source section of this three-piece lot to juxtaposition, and is different for every three light source sections so that drawing 23 may be the representative circuit schematic of this example and it may illustrate ... (or 92a, 92b ...) is connected.

[0075] The concrete example of a configuration is shown in drawing 21 and drawing 22 . drawing 21 -- the inside of circuit pattern 9' -- actually -- Resistance 91a and 92a -- the example incorporating ... it is -- drawing 22 -- circuit pattern 9' -- the width of face of ' -- the resistance sections 92a and 92b -- it is the example which changed resistance by changing by ...

[0076] In addition, the resistance of a circuit pattern is changeable also by changing thickness.

[0077]

[Effect of the Invention] According to invention according to claim 1, since the light of the light source is reflected and condensed by the light guide section, even if it separates the location of the light source from an optical output side, the futility of light does not arise. For this reason, when two or more light sources are made into the shape of an array, even if it lengthens distance of the light source and an optical exposure side, sufficient quantity of light can be obtained. And by lengthening distance, since the illumination light of almost uniform illumination distribution without a ripple can be obtained even if it lessens the number of the light source, the light source number can be reduced, and power-saving and a cost cut can be aimed at.

[0078] Since according to invention according to claim 2 light can be efficiently reflected in a light guide section and it can lead to the optical output side side of a translucent part (carrying out total reflection), efficiency for light utilization is high and the light source and an optical exposure side can be set up long enough.

[0079] According to invention according to claim 3, the light which spread around in the light source part can be used effectively, and the quantity of light which arrives at an optical output side can be raised.

[0080] Since it is the configuration that a circuit pattern is prepared in translucent part material, and the current supply source to the light source section is carried out with this circuit pattern according to invention according to claim 4, even if it exchanges the light sources, wiring can be used as it is and can lessen futility at the time of exchange.

[0081] According to invention according to claim 5, according to connector structure, since it can detach and attach freely to translucent part material, a light source part can perform exchange, repair, etc. of a light source part easily, and the precision of the immobilization also becomes exact. Moreover, since a light source part and translucent part material can detach and attach freely by having considered as connector structure in this way, it becomes possible to exchange only one side and reduction of the cost at the time of exchange can be aimed at.

[0082] According to invention according to claim 6, even when the die length of wiring to two or more light sources differs, respectively, the current value of each light source part can be adjusted, and it can be made regularity, and the stable quantity of light without dispersion can be obtained.

[Translation done.]

[Brief Description of the Drawings]

[Drawing 1] It is drawing showing the example concerning claims 1-3, and is drawing showing the appearance of light equipment.

[Drawing 2] It is drawing showing the important section of this light equipment.

[Drawing 3] It is drawing showing how depending on which the light of the light source part of this light equipment progresses.

[Drawing 4] It is drawing showing how depending on which the light of this light equipment progresses.

[Drawing 5] It is drawing showing other examples concerning claims 1-3, and is drawing showing how depending on which the configuration of light equipment and light progress.

[Drawing 6] It is drawing showing the important section of this light equipment.

[Drawing 7] It is drawing concerning the example of claim 2, and is drawing for explaining the setting approach of the tilt angle of a light guide section.

[Drawing 8] It is drawing showing the ripple condition of the light of this light equipment.

[Drawing 9] It is drawing showing the example concerning claim 4, and is drawing showing the appearance of light equipment.

[Drawing 10] It is drawing showing the appearance of this light equipment.

[Drawing 11] It is drawing showing the configuration of the translucent plate of this light equipment.

[Drawing 12] It is drawing showing the configuration of the light source section of this light equipment.

[Drawing 13] It is drawing showing the appearance of the connector of this light equipment.

[Drawing 14] It is drawing showing the example concerning claim 5, and is drawing showing the configuration of a translucent plate and the light source section.

[Drawing 15] It is drawing showing other examples concerning claim 5, and is drawing showing the configuration of a translucent plate and the light source section.

[Drawing 16] It is drawing showing the example concerning claim 6, and is the front view of a translucent plate.

[Drawing 17] It is drawing showing other examples concerning claim 6, and is the front view of a translucent plate.

[Drawing 18] It is drawing showing other examples concerning claim 4, and is the external view of light equipment.

[Drawing 19] It is drawing showing the configuration of the lightguide plate of this light equipment.

[Drawing 20] It is drawing showing the configuration of the light source section of this light equipment.

[Drawing 21] It is drawing showing other examples concerning claim 6, and is the front view and rear view of a lightguide plate.

[Drawing 22] It is drawing showing other examples concerning claim 6, and is the rear view of a lightguide plate.

[Drawing 23] It is the representative circuit schematic of the circuit pattern of the lightguide plate shown in drawing 21 and drawing 23.

[Drawing 24] It is drawing showing the configuration of conventional light equipment.

1 LED
2 Substrate
2a Crevice
4 Lightguide Plate
4a Translucent part
4b Light guide section
5 Translucent Plate
21 Side-Attachment-Wall Side (Light Reflex Side)
42 52 Optical output side
43 Side-Attachment-Wall Side (Inclination Interface)
9, 55, 56 Circuit pattern
6 Eight Light source section
60a, 60b, 91a, 91b Resistance (current control means)
11a, 11b, 92a, 92b Circuit pattern (current control means)

[Translation done.]

*** NOTICES ***

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] The substrate which has arranged two or more light sources which consist of LED etc. in the shape of an array, and the light guide section of the configuration where it has been arranged at each luminescence top panel side of two or more of said light sources, and the luminescence top panel side spread, Light equipment characterized by being arranged at the luminescence top panel side of said light guide section, having the translucent part which emits light from the glory output screen which introduced the light of each light guide section, accumulating the direct light from said light source, and the light reflected in respect of the side attachment wall of said light guide section, and making it output from said optical output side.

[Claim 2] Light equipment characterized by setting the tilt angle of the side-attachment-wall side of said light guide section as the include angle which carries out total reflection of the light of the light source in light equipment according to claim 1.

[Claim 3] Light equipment characterized by establishing the light reflex side which reflects the light of the light source in a luminescence top panel side in the substrate which has arranged said light source in light equipment given in either of claims 1 or 2.

[Claim 4] Light equipment characterized by supplying a current to the light source with which prepared the light source applied part and the circuit pattern in said translucent part material, and said light source applied part was equipped with said circuit pattern in the light equipment to which pass the inside of transparent translucent part material, and the light of the light source is made to output from the optical output side of this translucent part material.

[Claim 5] Light equipment characterized by the thing of said light source section and translucent part material for which connector structure was prepared in either at least, and the light source section and translucent part material were constituted free [attachment and detachment] electrically and mechanically while dividing and having the light source section including said light source, and the translucent part material which is made to pass the light of the light source and is made to output from an optical output side in light equipment according to claim 4.

[Claim 6] Light equipment characterized by preparing a current control means in either of claims 4 or 5 in the light equipment of a publication at the circuit pattern of said translucent part material.

[Translation done.]